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Effect of plant products and insecticides on bruchid *(Callosobruchus chinensis)* infestation, seed viability and vigour of soybean during storage

V.K. DESHPANDE*, HARISH H. DESHPANDE AND SANJAYA C. TOPAGI
Department of Seed Science and Technology, University of Agricultural Sciences,
DHARWAD (KARNATAKA) INDIA

ABSTRACT

Storage study on soybean seeds cv. JS-335 was initiated by treating the seeds with plant products and insecticides *viz.,* Asafoetida (1 g/kg), sweet flag rhizome powder (5 g/kg), lakke leaf powder (5 g/kg), neem seed powder (5 g/kg), malathion (5%) dust (1 g/kg) and methyl parathion 50 EC (1 ml/kg). The treated seeds were kept in the plastic jars and five pairs of freshly emerged adult bruchids were released and jars were covered tightly with muslin cloth. There was complete bruchid mortality with zero per cent bruchid population build up and no seed weight loss in seeds treated with sweet flag rhizome powder, neem seed powder, malathion dust and methyl parathion. The treatments were effective in maintaining satisfactory germination (70%) as per minimum seed certification standards up to six months besides higher seedling vigour.

Key words : Soybean, seed, *Callosobruchas chinensis*, Plant products, Seed viability, Vigour.

INTRODUCTION

Soybean is referred to as miracle crop and is valued greatly in daily human diet because of its high protein (40%), oil (20%), and carbohydrates (15%) besides, appreciable quantity of calcium, iron vitamins and minerals. Soybean is grouped under poor storer owing to delicacy of its seed coat, susceptibility to mechanical damage and lipid peroxidation (Delouche *et al.*, 1973). Further, storage seeds are also infested by the bruchids (*C. chinensis*) resulting in heavy quantitative and qualitative losses (Mookherjee *et al.*, 1970). Control of bruchids in storage by use of synthetic insecticides cause a health hazards. Therefore, it has become imperative to use natural plant products (*botanicals*) such as sweet flag rhizome, neem seed, lakke leaf were reported to control storage pests in several crops (Pandey *et al.*, 1976; Ghosh *et al.*, 1981 and Das and Karim, 1986). Further, plant products are cheap, easily accessible, non toxic and eco-friendly and may be used as alternative to control storage insects.

Information available on the efficiency of plant products on control of bruchids in relation to seed viability and seedling vigour during storage is meager. Hence, the present study was under taken in the department of Seed Science and Technology, University of Agricultural Sciences, Dharwad during 2009-10.

MATERIALS AND METHODS

Freshly harvested, un-infested soybean seeds (JS-335) were obtained from soybean scheme, University of Agricultural Sciences, Dharwad and one kg of seeds were treated with sweet flag rhizome powder (*Acorus calamus*) (5g), neem seed powder (*Azadirachta indica*) (5g), lakke leaf powder (*Vitex nigunda*) (5g), Asafoetida (Ingu) (1g), Malathion (5%) dust (1g) and methyl parathion 50 EC (1 ml) and were stored in plastic jar. Five pairs of freshly emerged adult bruchids (*Callosobruchus chinensis* L.) were released in to the containers. The treatments were replicated thrice. The mouth of the jars were covered with muslin cloth and tightly fastened with rubber band. The samples were drawn monthly for recording observations on per cent germination (Anonymous, 1999) and seedling vigour index (Abdul Baki and Anderson, 1973). Per cent mortality of adult bruchid was recorded at 24, 48 and 72 hours after release of the insects. Adult bruchid population was also recorded at 90 and 180 days after release of the insects. Per cent weight loss of the seed was also computed by taking initial and final weight. The data was statistically analyzed and presented in Table 1, 2 and 3.

RESULTS AND DISCUSSION

Significant differences in bruchid mortality were noticed in seeds treated with different plant products and chemicals (Table 1). Cumulative adult mortality was cent per cent in seeds treated with sweet flag rhizome powder, methyl parathion 50 EC, malathion dust and neem seed powder at 72 hours after release of the bruchids. In case of lakke leaf powder treatment, there was only 16.67 per dent mortality, *i.e.* while, *Asafoetida* treated seeds could not cause any adult bruchid mortality.

Adult insect population build up at 90 days after release was significantly higher in Asafoetida (191.0) treated seeds followed by lakke leaf powder (188.0),

* Author for correspondence.

Table 1: Effect of seed treatments on bruchid mortality (%), population build up and seed weight loss (%) during storage of soybean seeds

Treatments	Dosage	Percentage adult bruchid mortality at hours after release			Weight loss (%)		Population build of bruchids	
		24 hr	48 hr	72 hr	90 DAR	180 DAR	90 DAR	180 DAR
Asafoetida	1 g/kg	0.00^{d} (0.00)	0.00^{c} (0.00)	0.00^{b} (0.00)	31.32^{a} (34.00)	67.17^{b} (54.97)	191.30^{b}	383.00^{b}
Lakke leaf powder	5 g/kg	10.00^{c} (18.43)	16.67^{b} (24.04)	16.67^{b} (24.04)	30.29^{b} (33.43)	52.45^{c} (52.18)	188.0^{b}	381.33^{b}
Sweet flag rhizome powder	5 g/kg	100.00$_{a}$ (90.00)	100.00^{a} (90.00)	100.00^{a} (90.00)	0.00^{c} (0.00)	0.00^{d} (0.00)	0.00^{c}	0.00^{c}
Neem seed kernel powder	5 g/kg	86.67^{b} (68.85)	100.00^{a} (90.00)	100.00^{a} (90.00)	0.00^{c} (0.00)	0.00^{d} (0.00)	0.00^{c}	0.00^{c}
Malathion dust (5%)	1 g/kg	100.00^{a} (90.00)	100.00^{a} (90.00)	102.00^{a} (90.00)	0.00^{c} (0.00)	0.00^{d} (0.00)	0.00^{c}	0.00^{c}
Methyl parathion 50 EC	1 g/kg	100.00^{a} (90.00)	100.00^{a} (90.00)	100.02^{a} (90.00)	0.00^{c} (0.00)	0.00^{d} (0.00)	0.00^{c}	0.00^{c}
Control	-	0.00^{d} (0.00)	0.00^{c} (0.00)	0.00^{d} (0.00)	31.42^{a} (34.48)	73.06^{a} (58.73)	214.33^{a}	414.33^{a}
C.D. (P=0.05)		3.11	3.019	3.019	0.4699	1.222	3.147	8.415

Figures in the parentheses are angular transformed values
Values followed by the same letter in the column do not differ significantly at 5 % DMRT
DAR – days after release

Table 2 : Effect of seed treatment and bruchid infestation on seed germination (%) and seedling vigour index during storage of soybean seeds

Treatments	Dosage	Germination percentage at days after storage						Seedling vigour index at days after storage					
		30	60	90	120	150	180	30	60	90	120	150	180
Asafoetida	1 g/kg	90.66^{b} (72.24)	90.33^{b} (71.89)	87.34^{b} (69.19)	77.34^{c} (61.58)	55.00^{b} (47.88)	27.67^{c} (31.43)	3048.40^{c}	2771.84^{c}	2590.25^{b}	2197.86^{c}	1285.94^{c}	0383.88^{d}
Lakke leaf powder	5 g/kg	91.33^{b} (72.90)	90.66^{b} (72.23)	87.00^{b} (68.93)	77.67^{c} (61.82)	48.00^{c} (44.04)	23.34^{d} (28.87)	3140.57^{ab}	2771.42^{c}	2547.17^{b}	2102.66^{c}	1022.45^{d}	0254.71^{e}
Sweet flag rhizome powder	5 g/kg	95.00^{a} (77.12)	94.00^{ab} (75.85)	90.67^{a} (72.21)	84.34^{a} (70.99)	86.00^{a} (68.03)	84.00^{a} (66.42)	3098.17^{bc}	3055.16$_{a}$	2828.13^{a}	2729.43^{a}	2472.17^{ab}	2335.98^{b}
Neem seed kernel powder	5 g/kg	95.66^{a} (77.98)	93.00^{ab} (76.68)	91.00^{a} (71.57)	84.33^{b} (66.70)	83.00^{a} (65.35)	81.67^{b} (64.16)	3163.57^{ab}	2881.96^{b}	2708.80^{a}	2403.83^{b}	2316.69^{b}	1969.93^{c}
Malathion dust (5%)	1 g/kg	97.67^{a} (78.00)	95.00^{a} (77.12)	91.67^{a} (73.22)	89.34^{a} (71.28)	85.33^{a} (67.50)	83.67^{ab} (66.17)	3165.91^{ab}	3102.85^{a}	2851.06^{a}	2660.66^{a}	2407.96^{b}	2311.52^{b}
Methyl parathion 50 EC	1 g/kg	96.66^{a} (79.56)	95.67^{a} (78.06)	91.33^{a} (72.88)	89.34^{a} (70.95)	86.34^{a} (68.32)	82.00^{ab} (65.62)	3214.60^{a}	3105.88^{a}	2779.80^{a}	2690.16^{a}	2576.38^{a}	4180.04^{a}
Control	-	84.33^{c} (66.79)	61.67^{c} (54.83)	43.33^{c} (40.19)	31.67^{d} (34.14)	20.00^{d} (26.45)	5.00^{e} (13.34)	3052.49^{c}	1852.86^{c}	1071.36^{c}	0657.16^{d}	0366.86^{e}	0023.26^{f}
C.D. (P=0.05)		3.34	3.70	2.32	3.84	3.59	1.94	176.70	71.97	176.70	161.0	148.60	88.90

Figures in the parentheses are angular transformed values
Values followed by the same letter in the column do not differ significantly at 5 % DMRT

Table 3 : Effect of seed treatment and bruchid infestation on seedling length and seedling dry weight during storage of soybean seeds

Treatments	Dosage	Seedling lenght (cm) days after storage						Seedling dry weight (mg/ seedling) days after storage					
		30	60	90	120	150	180	30	60	90	120	150	180
Asafoetida	1 g/kg	33.63	30.67^{b}	29.65^{bc}	28.42^{b}	23.32^{c}	13.75^{d}	0.993	0.893	0.703^{b}	0.703^{b}	0.497^{d}	0.337^{c}
Lakke leaf powder	5 g/kg	34.63	30.62^{b}	29.27^{c}	27.09^{c}	21.12^{d}	10.95^{e}	0.990	0.863	0.730^{b}	0.697^{b}	0.480^{d}	0.383^{c}
Sweet flag rhizome powder	5 g/kg	32.60	32.50^{a}	31.18^{a}	30.57^{a}	28.75^{ab}	27.91^{a}	0.990	0.893	0.843^{a}	0.810^{a}	0.693^{c}	0.70^{a}
Neem seed kernel powder	5 g/kg	33.06	30.98^{b}	30.08^{abc}	28.50^{b}	27.92^{a}	24.31^{c}	0.993	0.877	0.810^{a}	0.793^{a}	0.730^{bc}	0.623^{b}
Malathion dust (5%)	1 g/kg	33.08	32.65^{a}	31.10^{ab}	29.66^{ab}	28.23^{ab}	26.26^{b}	0.990	0.893	0.850^{a}	0.813^{a}	0.77^{ab}	0.697^{a}
Methyl parathion 50 EC	1 g/kg	33.25	32.45^{a}	30.72^{abc}	30.07^{a}	29.85^{a}	27.51^{a}	0.990	0.867	0.850^{a}	0.820^{a}	0.79^{a}	0.60^{ab}
Control	-	33.02	30.02^{b}	25.03^{d}	20.87^{d}	18.26^{e}	4.35^{f}	0.993	0.887	0.720^{b}	0.620^{c}	0.423^{c}	0.11^{d}
C.D. (P=0.05)		NS	1.058	1.392	1.331	1.751	0.9316	NS	NS	0.056	0.553	0.050	0.5538

Values followed by the same letter in the column do not differ significantly at 5 % DMRT NS-Non significant

while, in sweet flag rhizome powder, neem seed powder, melathion and methyl parathion treated seeds, adult population build up was nil and the same trend was seen even at 180 days after storage. Cent per cent mortality and no population build up was observed with sweet flag rhizome powder, neem seed powder, malathion and methyl parathion treatments, this might have been due to presence of some insecticidal property (Ghosh *et al.,* 1981; Das and Karim, 1986: Ravikumar *et al.,* 1987 and Ramesh, 1993). Like wise, per cent seed weight loss was also least in these treatments. The weight loss was significantly higher in control followed by Asafoetida and lakke leaf powder and was nil in the rest of the treatments. Record of no loss in seed weight in case of sweet flag, neem seed powder, malathion dust and methyl parathion due to effective mortality of bruchids within 24 hours and thus reflected complete control of population build up. Similar type of finding was also reported in pulses with the use of plant products (Ramesh, 1993 and Shivanna *et al.,* 1994) and insecticides (Ravikumar *et al.,* 1987).

The results on the seed quality parameters (Table 2 and 3) revealed satisfactory seed germination above the minimum seed certification standard (70%) in seeds treated with sweet flag rhizome powder (84.0%) followed by malathion dust (83.67), methyl parathion (82.00%) and neem seed powder (81.67%) while it was very less in Asafoetida (27.67%), lakke leaf powder (23.34%) and control (5.0%). Like wise same trend was followed in seedling length, seedling dry weight and seedling vigour index. Higher germination, seedling length, seedling dry weight and vigour index were noticed with sweet flag, neem seed powder, malathion dust and methyl parathion seed treatment due to existence of some insecticidal property leading to higher bruchid mortality with least population build up and no seed weight loss (Ravikumar *et al.,* 1987; Ramesh, 1993 and Shivanna *et al.,* 1994).

Conclusion:

From the results of the present study it may be concluded that for effective control of bruchids in storage, soybean seeds should be treated with plant products such as sweet flag rhizome powder and neem seed powder instead of malathion dust or methyl parathion insecticides as the plant products are cheap, easily available, non toxic, eco-friendly maintain higher germination and seedling vigour during storage.

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